of the face, two of the chest, with precise records of the colour of skin, eyes, and hair. The statistical staff of the Prudential Insurance Company of America has undertaken to deal with the data collected, while the Smithsonian Institution will faciliate the publication of results.

Although the intentions of the British committee are more wide-reaching and aim at ascertaining the condition of all elements in the population, it is to be hoped that the observations taken in Britain and America will be capable of direct comparison—for, beyond doubt, the bulk of the population of the United States has a British ancestry.

PROF. CHARLES LATHAM.

BY the sudden death of Prof. Charles Latham on September 27, the University of Glasgow has lost an eminent member of its teaching staff in the department of applied science. In 1902 the late Dr. James S. Dixon, an eminent coalmaster of Glasgow, "recognising the want of a means of teaching the higher branches of the theory and practice of mining in the University, and the desire for acquiring such knowledge displayed by many young men connected with mining," gave the University 10,000*l.* for the foundation of a lectureship in the subject. In the various branches of engineering, and in naval architecture, curricula were already provided which prepared for the degree of B.Sc. in applied science. Mining was added as an alternative curriculum, and the new department was entrusted to Mr. Latham. He had been trained in the Wigan School of Mines, and had been assistant general manager of the Moss Hall Coal Co. For nine years (1893–1902) he was director of mining at University College, Nottingham. The first Dixon lecturer speedily made his department efficient, and his numerous courses of instruction attracted many pupils.

In 1907 Dr. Dixon supplemented his original endowment by 6500*l.*, and the University, with the consent of the Privy Council, transformed the lectureship into a chair. To this Mr. Latham was forthwith appointed, the electors including H.M. Inspectors of Mining and the presidents of the Scottish Mining Institute and the Coalmasters' Association. In the new chair Prof. Latham continued to devote himself to the advancement of his subject by teaching and research. He raised a considerable Equipment Fund, by means of generous contributions from the leaders of the Scottish mining industries, who had great confidence in his policy and character. Assisted by the fund, the University was enabled to equip the museum and laboratory of the department with valuable exhibits and apparatus, and Prof. Latham gave himself to the training of his pupils and assistants in the practical and experimental sides of their work, and in original investigations on mine-pumps, winding machinery, coal-cutting, inflammable gases, life-saving appliances, etc. His course was recognised by the Home Office as equivalent to two of the five years' practical training required under the Coal Mines Acts for the qualification of mine manager. By arrangement with a number of the largest collieries in Scotland, his students were enabled, during the summer months of each year of the course, to acquire experience of mining practice. Many of them now occupy responsible positions in the industry, and in technical institutions throughout the country. Prof. Latham served on numerous advisory and other committees relating to mining, and published, in the Transactions of the Mining Institute and elsewhere, memoirs of importance on his researches in the above-mentioned subjects.

NOTES.

THE Minister of Reconstruction has appointed a committee to advise him as to the procedure which should be adopted for dealing with the position of the chemical trades after the war. The committee consists of the following members:—Sir Keith W. Price (chairman), Mr. J. Anderson, Mr. J. F. Brunner, Dr. C. Carpenter, Prof. J. G. Lawn, Sir William Pearce, Mr. K. B. Quinan, and the Right Hon. J. W. Wilson. Mr. G. C. Smallwood, Ministry of Munitions, will act as secretary to the committee. The officers of Government departments are appointed with the concurrence of their respective Ministers, and the other members of the committee have been appointed at the suggestion of a representative meeting of chemical manufacturers. Dr. Addison has requested the committee to conduct its deliberations with a view to the creation of some organisation which should be adequately representative of the trade as a whole, and by means of which the trade may be enabled hereafter to continue to develop its own resources and to enlist the closest co-operation of all those engaged in the chemical industry.

ON October 6 Prof. W. J. Pope addressed a meeting of teachers at Regent Street Polytechnic on the neglect of expert knowledge of scientific subjects by the British Government. Germany, he is reported by the *Times* to have said, prepared for war by the establishment of a huge chemical industry, which was built up round the coal-tar industry, and then by exporting a large proportion of the world's requirements of coal-tar colours and pharmaceutical and photographic products. This success was achieved in spite of the fact that England once possessed the whole of the heavy chemical industry of the world. We formerly produced practically all the nitric and sulphuric acids and the greater part of the alkali used throughout the world. This industry has been taken from us as the result of Germany's foresight and exploitation of scientific ability. The coal-tar industry was established originally in this country, and until ten years ago Germany was practically dependent on us for crude coal-tar and for the simpler first products separated from coal-tar. Alluding to the establishment of the Department of Scientific and Industrial Research with an endowment of 1,000,000*l.*, Prof. Pope remarked that the question to be answered is why that experiment was not made twenty years ago, at a time when it would have been undoubtedly successful in preventing the horrors of the last three years. We have suffered in the past from the exclusively British method of making the specialist entirely subservient to the administrator, the administrator being generally chosen because he is available, because he is politically acceptable, and because he knows nothing whatever about the subject which is to be administered, and is therefore not likely to be prejudiced by any previous convictions. The process of appointing someone who knows nothing to supervise the work of someone who does know how to do the job seems to have been at the bottom of a great many of our misfortunes in the past. In 1915 the Government applied the same method to re-establish the coal-tar industry in this country. An organisation was established in which all the people in control were men who knew nothing of chemistry or science, and, naturally enough, the Government organisation has proved a failure. Organisation apparently was to do everything that was necessary, and consequently private effort was to a considerable extent hampered. Such prevalent, but entirely mistaken, activity arises, Prof. Pope claimed, from a lack of education. If it were generally demanded that no person should be regarded as reasonably educated who had not mastered the rudimentary principles of natural science and of scientific method, this mistaken policy in connection with the coal-tar colour question would have been impossible.

ON the invitation of the British Engineering Standards Committee, the American Institute of Electrical Engineers has sent over Mr. H. M. Hobart to represent the institute at a conference to be held with Sir Richard Glazebrook's Panel Committee on Standardisation Rules for Electrical Machinery. Mr. Hobart is the author of several standard treatises on electrical machinery, and was for many years a lecturer at Faraday House Engineering College before he returned to America about ten years ago. He is decidedly *persona grata* to the engineers in this country, and a happier or more tactful choice could not have been made. The standardisation rules of the American and English electrical engineers are in substantial agreement, and we see no reason why complete agreement should not be obtained. The Americans have had far greater experience with pressures exceeding 50,000 volts than we have had, and they are fully aware that testing apparatus with very high voltages may permanently weaken the insulation, although the apparatus may survive the test. The exact way of taking the temperature measurements of machines under load and the methods of testing the dielectric have been discussed at previous conferences. Electricians are practically unanimously in favour of the metric and decimal systems, but the standard pressure for lighting in this country seems to be anything between 220 and 240 volts. It is to be hoped that the lead which the Glasgow Corporation gave to the country many years ago, by fixing 250 as the standard voltage for lighting, will be generally adopted.

THE recent air raids have provoked much discussion as to our future air policy, and as to possible improvements in aircraft design. The question of reprisals is more a moral than a technical one, as there is no doubt of our ability to carry out effective raids on German towns. Lord Montagu of Beaulieu, in a letter to the *Times*, points out that the air-raid casualties are really small, and fewer than those due to London traffic. This is poor consolation, and should not prevent the utmost efforts to secure an effective means of defence. At a meeting "in support of an increased air service," held at the Central Hall, Westminster, on October 4, Mr. Joynson Hicks criticised the Government very severely, stating that warnings had been neglected and that progress was consequently slow. He spoke of the improvement in aircraft during the last few years, and said that in his opinion another year would see machines flying at 250 miles an hour instead of 150. He implied that the Government knows that such machines are possible, but is not preparing for them. Such a statement as the above shows a lack of knowledge of the principles governing flight. A machine must be able to land at a reasonably low speed, as well as to fly at a high speed, and the landing speed at once imposes a limit on the top speed. Thus, with a landing speed of forty miles per hour a machine of good design, weighing one ton, needs 200 horse-power to fly at 100 miles per hour, and would require 1700 horse-power to fly at 200 miles per hour. If the landing speed is raised to eighty miles per hour—a very high value in practice—90 horse-power will be required at 100 miles per hour, and 400 horse-power at 200 miles per hour. Mr. Joynson Hicks's 250-mile-an-hour machine would require 800 horse-power to fly it, even with a prohibitive landing speed of eighty miles per hour. Such a machine is obviously impracticable with present-day engines, and with any engine likely to be evolved in the near future. The engine alone would weigh one ton, which is the total weight of the machine for which the above calculation was made. Our best present-day machines are near the limit of practicability with existing engines, and every possible effort is being made to improve their performance by careful scientific attention to details of design.

DR. ADDISON, the Minister of Reconstruction, speaking on October 3 at the annual meeting of the Library Association, said that one of the features of the programme which appealed to him was the movement, which was apparently making considerable progress, for the formation of technical and commercial libraries and for the setting up of research libraries to suit the particular needs and industries of various districts. If we are to pay for the war—and it is not necessary to put the matter on a higher plane than that—we want the different trades and industries of the country to organise more and more for the production and dissemination of useful and necessary information. A working relationship between higher educational authorities and the business community is absolutely essential to our industrial welfare, and public libraries can do a valuable work by placing information useful to industry at the disposal of the community. Certain recommendations were made at the meeting. The council of the association is of opinion that it is of urgent national importance to increase the supply of scientific and technical books and periodicals, the existing supply being quite inadequate for higher research, and, in many places, insufficient for the requirements of the student and the artisan. To this end it was strongly urged (*a*) that local authorities should afford more generous support to public libraries for the provision of scientific and technical literature; (*b*) that municipal and other library authorities and institutions should co-operate in issuing union catalogues of technical books, and adopt such other co-operative methods as will make their resources available over wider areas; (*c*) that a State scientific or technical library should publish periodically a descriptive list of selected books in science and technology; (*d*) that a closer union should be arranged between State and copyright libraries on one hand, and municipal libraries on the other, so that the resources of the former may directly or indirectly be made available for scientific and technical students in the great industrial areas of the provinces; and (*e*) that funds should be provided for some State-supported library, such as the Science Library of South Kensington, or a library controlled by the Department of Scientific and Industrial Research, to purchase books required for research, and to make them available for loan to public libraries. All the recommendations were adopted unanimously.

A GENERAL discussion on pyrometers and pyrometry will be held by the Faraday Society at the Royal Society of Arts on Wednesday, November 7. Sir Robert Hadfield, president of the society, will preside over the discussion, and deliver an introductory address. Instruments for high-temperature measurements will be exhibited by leading makers.

Prof. G. H. Bryan has received from the Department of Scientific and Industrial Research a grant to enable him to complete the researches into some of the unsolved problems as to the effects of atmospheric and other disturbances, such as gusts, air-pockets, bomb-throwing, etc., upon aeroplanes, referred to in his "Stability in Aviation." He has been granted leave of absence for a year from the University College of North Wales, where he is professor of mathematics, and has proceeded to the University of Bristol, where he proposes to work for a time.

Announcement is made that Mr. Walter Long, who has been requested by the War Cabinet to take control of all questions affecting petroleum oils and petroleum products, has appointed Prof. J. Cadman to be his technical adviser and liaison officer between the various Government departments. Prof. Cadman will also take charge of an organisation to be established for giving effect to Mr. Long's instructions, and will assume the title of Director of the Petroleum Executive. Mr. E. S. Shrapnell-Smith has been appointed economy officer to the Petroleum Executive, and he will be concerned in introducing economies both in the Services and in the civil use of petroleum and petroleum products. The headquarters of the Petroleum Executive are at 8 Northumberland Avenue, W.C.2, to which all communications should be addressed.

Melbourne newspapers of August 10 and 11 contain accounts of large magnetic disturbances which occurred on the afternoon of August 9 and on the forenoon of August 10, Australian time. These clearly correspond with disturbances recorded in England during the morning and late evening of August 10, Greenwich time. The earlier of the two disturbances, lasting from about 2 to 8 p.m. local time, was accompanied by bright aurora. At Melbourne there was a brilliant display of streamers for about an hour. At Ballarat the aurora, being of a ruddy tint, was mistaken for a conflagration, and the fire brigades turned out. There were also strong earth currents throughout Australia, interfering with the telegraph service, especially in Victoria and New South Wales.

The Royal Photographic Society is holding its annual exhibition this year in the society's own house at 35 Russell Square, W.C. Admission is free for about six weeks. The autochrome process still holds its own for colour transparencies, though the few results on Paget plates leave little or nothing to be desired so far as an inspection, without the original for comparison, is concerned. The Astronomer Royal, Greenwich, has contributed recent photographs of sun-spots, nebulæ, comets, and star regions. Among other astronomical photographs taken with telescopes of very large aperture are several by Mr. J. H. Reynolds, of Birmingham. These include series of the moon, Jupiter, Brooks's comet, and the great nebula in Orion. The photomicrographs are far more numerous than usual, and vary very much in quality. An experiment by Dr. Rodman, made at the suggestion of Capt. Owen Wheeler, of using a more highly corrected lens as eyepiece (a Ross ¼-in. achromatic objective was used instead of the "ordinary ocular") distinctly discourages any further attempts in this direction. Mr. Ernest Marriage shows an extensive series to demonstrate the comparative proportion of starch in plant roots, especially in those plants that market-gardeners would wish to be rid of. He photographs sections (×5) as cut, and also after treatment with iodine, the darkening with iodine indicating starch. Photographs at ×250 show the starch granules. There are notable collections of radiographs, natural history photographs, and other matters too numerous to mention. Doubtless the photographs of the widest general interest are those contributed by the Royal Flying Corps. The exigencies of the times have caused aerial photography to advance to a perfection scarcely thought possible a few years ago. The photographs show definitely the changes in buildings, trenches, etc., during the various stages of the war.

It is announced that the Ministry of Munitions does not regard coal-gas as coming within the category of a petrol substitute. On the question of the unrestricted use of gas, the Ministry states that it is consulting the Home Office. The motor industry has now taken up this substitute for petrol, which involves only a slight alteration to the engines of the vehicles. Gas has been used as the motive power in many char-à-bancs during the summer season, the fuel being stored in a large bag carried on the roof. The question as to how gas can be stored in motor-cars, taxi-cabs, etc., has given rise to the adoption of several plans. Open motor-cars are not adapted to the carriage of gas-bags, and the experiment of using light trailers for that purpose is being tried. In the case of taxi-cabs little difficulty will arise, and a slight alteration of the front seats on the top of motor-omnibuses is all that is necessary for the storage of bags. It is likely that gas will be adopted largely, since it can be obtained at about one-fourth the present price of petrol. Owing to the difficulty of procuring steel cylinders, compressed gas is not likely to come into use during the war; there is also the point to be considered that coal-gas stored under pressure is liable to deteriorate.

A Reuter message from Tokio, dated October 1, which appeared in the *Times* of October 4, reports the occurrence in Japan of a typhoon of unprecedented violence, which swept over Tokio on the morning of that day, lasting for four hours. The casualties caused by the visitation appear to have been deplorably numerous, and the destruction of property exceptionally great, thousands of people being rendered homeless. The typhoons of the North Pacific and China Seas are divided by the Rev. J. Algué, S.J., director of the Manila Observatory, in his "Cyclones of the Far East," into classes, according to the zones of their trajectories: those of the North Pacific, all of which keep to the west of the twenty-fourth meridian, East; and those of the China Sea, which cross this meridian. It is the former to which the typhoons that visit Japan belong. Fr. Algué then groups these conformably with the months of their occurrence; the mean inclination of their branches (1) before, (2) after they have recurred; also the mean latitude of their vertex. Reduced to three groups, December to March, inclusive, is the first; April, May, October, November, the second; June to September, inclusive, the third. The typhoon of October 1 belongs rather to the third group of trajectories than to the second, because in the case of the former the latitude of its vertex is highest of all the groups. The zone of origin of typhoons of the first group lies between the parallels of 5° N. and 12° N.; that of the second between 6° N. and 17° N.; that of the third between 8° N. and 20° N. In the Philippines a typhoon with an hourly velocity of motion exceeding twelve nautical miles is said to travel rapidly; when at fewer than from six to twelve miles an hour to move slowly, but to have a regular velocity when it progresses at that rate.

An interview with Sir Henry Trueman Wood published in Sunday's *Observer* (October 7) brings together several interesting reminiscences of his long association with the Royal Society of Arts, of which he was secretary from 1879 until his recent retirement. Among the distinguished representatives of applied science who were chairmen of the council from that year onwards were Sir Frederick Bramwell, Sir William Siemens, Sir J. Wolfe Barry, Sir William Preece, and Sir William White. Dr. Dugald Clerk has just retired from the chairmanship, and has been succeeded by Mr. Campbell Swinton. The society played a large part in the foundation of the Great Exhibitions of 1851 and 1862, and, through these, of that long series of international exhibitions which had such far-reaching influence on the arts, as well as on industry and trade. Sir Henry had much to do with the organisation of the Health, Inventions, and Colonial Exhibitions at South Kensington, the Paris Exhibition of 1889, and the Chicago Exhibition of 1893, for which the Government appointed the council of the Society of Arts as the British Commission. With regard to this exhibition, Sir Henry, who managed the British Section in Chicago, said:—"The amount given by our Government, though fairly liberal, was nothing compared with that which the German and French Governments gave. The Germans had never exhibited at big exhibitions before, because they had all been held in France, and after the Franco-Prussian War they would have nothing to do with them. They gave their commissioner an absolutely free hand. He told me himself he had as much money as he could do with. The result was that they made a much finer show in buildings than we could do. I do not think their actual exhibits were as good as ours, but the way in which they were shown was infinitely superior." Throughout his long association with the society, Sir Henry was always ready to assist other organisations having the application of scientific knowledge as their object. In the early days of the British Science Guild his active co-operation in many directions, and the hospitality afforded by the society as regards the use of rooms for meetings, were of the highest assistance; the aid thus given will long be gratefully remembered.

In the issue of *Knowledge* just published (No. 582) MM. Albert and Alexandre Mary describe experiments, in continuation of the late Dr. Charlton Bastian's work, on the development of micro-organisms in carefully sterilised solutions of certain salts, *e.g.* potassium ferrocyanide and ferrous sulphate. Tubes after being charged were sealed and sterilised for ten minutes at 130° C. The tubes, after standing for a year and a half, were opened and examined, and all yielded growths of micrococci which could be cultivated in iron lactate solutions. They affirm, therefore, the correctness of Dr. Bastian's work. In the same number Dr. Butler Burke, commenting on Mr. Onslow's communication to Nature of February 22 last on a repetition of Dr. Bastian's experiments with negative results, suggests that some kind of radiation other than sunlight, such as radioactivity, may prove to be the stimulant required to start vital processes in non-living matter, and so to cause the spontaneous generation of the living from the non-living.

Mr. J. A. Cushman has published (Bulletin 71, U.S. Nat. Mus., pp. 103, 52 text-figures, 39 plates, 1917) the sixth and last part of his work on the Foraminifera of the North Pacific, which deals with the single family Miliolidæ. Preceding the systematic account of the species recorded are detailed descriptions of the development of nine genera (and observations on their derivatives), beginning with Cornuspira.

In the report of the Dove Marine Laboratory at Cullercoats for the year ending June 30 Prof. A. Meek and Miss Stone record the results of examination of about 3000 herrings caught off the Northumberland coast. These show that the year 1916 was abnormal in that the herring caught were for the most part a year older—their scales having four winter rings—than those obtained during the years 1912–15. Miss Jorgensen gives a short description of the development of the common shore sponge, *Grantia compressa.* She agrees with Prof. Dendy that the oogonia arise from collared cells. Prof. Meek contributes a brief account of the Phoronidea, making special reference to *Phoronis ovalis,* which was rediscovered recently by Dr. Harmer in a shell obtained off the Northumberland coast. Prof. Meek states his reasons for believing that *Actinotrocha branchiata* is the larva of *P. ovalis.* He reports on larval lampreys collected in the North Tyne, but although the larvæ are so common, efforts made to secure the adults have thus far failed. He directs attention to the serious nature of the pollution of the Tyne in the neighbourhood of Newcastle and the consequent destruction of descending kelts and smolts and of sea-fish which are drifted up the river, and urges that steps should be taken to render effluents innocuous before they are poured into the river.

In his presidential address to the Quekett Microscopical Club, published in the Journal, vol. xiii., Prof. A. Dendy gave an interesting account of the development of the chessman spicule of the sponge Latrunculia, and discussed the view that the position of the whorls of outgrowths on the spicule correspond with the nodal points of a vibrating rod. The evidence suggests that the formative cells of the spicule are sensitive to vibrations and avoid the internodes, taking up their positions on the surface of the young spicule at the points of comparative rest of the vibrating rod, and thus the whorls present in the adult spicule are formed at these points by local accumulations of silica. Profs. Dendy and Nicholson have since published (see Nature, June 14, p. 318) an account of their mathematical study of a spicule with simpler whorls, the observed positions of which correspond closely with the calculated positions of the nodes in a vibrating rod similar in form to that of the shaft of the spicule when the nodes are commencing to develop. In the same volume of the Quekett Club's Journal Mr. G. T. Harris gives the results of studies on the desmid flora of Dartmoor, based on two hundred gatherings made in July–October, 1915 and 1916. The total number of species and varieties recorded is about 400. Some of the rarer species are figured and are the subject of special notes. The richness of the desmid flora of Dartmoor lends support to the view that "the rich desmid areas correspond geographically with pre-Cambrian and older Palæozoic outcrops."

The principal features of scientific interest in the current number (vol. xlii., parts 2 and 3) of the Journal of the Royal Horticultural Society are the reports on the experimental work at Wisley and a report of investigations relating to Paradise apple stocks, which is contributed by Mr. R. G. Hatton as the first report of the Wye College Fruit Experiment Station, East Malling. The latter is a detailed record of experimental work on this important subject which has been carried out at the station since November, 1912. Nine distinct types have been identified from English sources, whilst six other types have been obtained from German sources. The report is profusely illustrated, and reveals substantial progress towards the solution of what has long been regarded by fruit-growers as an important problem.

Agriculturists are indebted to Prof. T. B. Wood for a useful series of tables of the composition and nutritive value of feeding-stuffs which is issued by the Cambridge University Press. The tables cover the whole range of farm feeding-stuffs, and give information as to average composition, digestible nutrients, food units, nutritive ratios, and relative values for maintenance and productive purposes, the last-named being expressed in the now familiar form of "starch equivalents." Wherever possible the averages are based upon analyses of the materials actually used by British farmers, and this feature alone renders the tables invaluable and indispensable to all concerned in the inculcation and carrying out of rational methods of feeding live stock in this country.

The Food Production Department of the Board of Agriculture and Fisheries has issued a report (Miscellaneous Publications, No. 19) on the methods adopted in breaking up grass land during the past winter, and on the results achieved. The report is based upon the replies furnished by more than 300 farmers in fifty-five counties, to whom schedules of questions were addressed. In view of the difficulties attending the work last spring the results are considered to be very satisfactory, failure being reported in only one-fifth of the cases dealt with. Although some of the failures cannot be accounted for, most of them were due to reasons which further experience should enable farmers to avoid. Failures occurred chiefly in the south and east. In by far the greater number of cases wireworm was reported as the ostensible cause of failure, but it is suggested that in many of these cases the damage was primarily due to the drying out of the newly ploughed soil through lack of proper tillage, whilst in other cases it was almost certainly due to fritfly. There was general unanimity that the production of a firm seed-bed by pressing or heavy rolling after the plough is of prime importance for success. In a discussion of the lessons drawn from the successes and failures of 1917 much useful guidance is furnished as to time of ploughing, subsequent cultivation, and manuring in relation to land of different types. A brief *résumé* of the report is issued separately as Food Production Leaflet No. 5.

Messrs. Honda and Ishiwara describe, in a report from the Alloys Research Institute of the Tohôku University, Japan, the results of tests on the magnetic properties of manganese-antimony alloys in a field of about 500 gauss. Manganese is paramagnetic, and antimony diamagnetic, but their compounds, Mn_3Sb_2 and Mn_2Sb, are both ferromagnetic with a critical temperature at 315° C. Magnetisation at different high temperatures was also measured. This gives important data with regard to the structure of the alloys.

In a report from the Alloys Research Institute of the Tohôku University, Japan, Messrs. Honda and Murakami publish certain data with regard to the thermomagnetic properties of the carbides found in steels. They find that iron cementite is ferromagnetic, the specific magnetisation of which ($\rho=2{\cdot}559$) in a field of 500 gauss is 19·7. Its critical temperature is 215° C. In the free state it is almost wholly decomposed into its components by heating it sufficiently long at 900° C. The double carbide of iron and tungsten found in low tungsten steels is also ferromagnetic, and its specific magnetisation ($\rho=1{\cdot}435$) in a field of 500 gauss is 15·5. Its critical temperature is 400° C., and in the free state it is decomposed on heating to 850° C.

The August number of the Journal of the Franklin Institute contains a valuable outline of the publications on the subject of the submarine and its equipment which have appeared in the technical Press during the last six years. It is due to Helen R. Hosmar, and deals in order with the history of the development of the submarine, its proper function in war, the power and dimensions of the most recent submarines built in different countries, the various forms of internal-combustion engine used for propulsion on the surface, and of storage cells for use when submerged, the periscopes, and the forms of apparatus for signalling to and from submarines. A list of builders and a bibliography conclude the article, which occupies fifty-five pages of the journal. The outlines given are sufficient to give the reader a good general knowledge of the rapid advances which have taken place during the last few years, while the bibliography provides the references which enable the specialist to turn to the original sources for detailed information.

An article in *Engineering* for October 5 contains some interesting particulars of ferro-concrete shipbuilding. It is satisfactory to learn that Lloyd's Register of Shipping has approved plans for the construction of a number of such ships up to 500 tons dead-weight capacity. A director of the Norwegian Veritas has lately given his views, unofficially. He is convinced that ferro-concrete, under normal conditions, will be used for lighters, floating docks, buoys, etc., where the weight does not play a very important part. So far as sea-going vessels are concerned, he is of opinion that the weight of ferro-concrete vessels will detract from their carrying capacity to a serious extent. The Fougner yard in Norway has already commenced work on its eighteenth ferro-concrete floating structure—a floating dock—while several vessels up to 1000 tons dead-weight have been contracted for. Sister companies of the Fougner firm are in course of formation in England and America. M. Harald Alfsen, of the Norwegian company, has from the outset been convinced that ferro-concrete boats should be built bottom uppermost, and by using only an inner shuttering, or only outer boarding, so far as the vertical sides are concerned. The vessel takes the water bottom upward, in the position in which it is cast, and is turned upright after launching. The article contains an illustrated description of the ferro-concrete ship, *Beton I.*

One of the completest and most conveniently arranged special catalogues of second-hand books that have recently reached us is New Series No. 81, Zoological, just issued by Messrs. John Wheldon and Co., 38 Great Queen Street, W.C.2. It is divided into two parts—classified subjects and faunas of all countries—and should appeal to all zoological readers, being very easy of reference and containing many scarce works and others not easily obtainable at the present time, being of foreign origin. We notice that Messrs. Wheldon are offering for sale a set of the *Phil. Trans.* of the Royal Society from 1665 to 1913; Proceedings of the Royal Society from 1800 to 1916; the *Ibis* from 1859 to 1915; Bulletin of the British Ornithologists' Club, vols. i. to xxxiv.; Transactions of the Linnean Society from 1791 to 1916; a complete set of the *Zoologist*; and Nature from its commencement to 1916.

The new announcement list of the Cambridge University Press contains the following books:—"The Theory of Electricity," G. H. Livens; "British Grasses and their Employment in Agriculture," S. F. Armstrong, illustrated; "Instinct in Man: A Contribution to the Psychology of Education," Dr. J. Drever; "Locke's Theory of Knowledge and its Historical Relations," Prof. J. Gibson; "Agriculture and the Land," G. F. Bosworth (Cambridge Industrial and Commercial Series); and a new and revised edition of

"Manuring for Higher Crop Production," Dr. E. J. Russell.

A book which should be of interest and value is announced by the Chiswick Press, viz. "The Ancient Earthworks of the New Forest," described and delineated in plans founded on the 25-in.-to-one-mile Ordnance Survey, with a coloured map showing the physical features of the ancient sites of the New Forest founded on the 1-in.-to-one-mile Ordnance Survey, by H. Sumner.

Messrs. Longmans and Co. announce a new edition of Sir W. Crookes's "The Wheat Problem," containing an additional chapter on "Future Wheat Supplies," by Sir R. H. Rew, and an introduction by Lord Rhondda.

OUR ASTRONOMICAL COLUMN.

Ephemeris of Encke's Comet.—The following ephemeris of Encke's comet, which is due at perihelion on March 25, 1918, is given by M. Viljev :—

1917	R.A. h. m. s.	Decl. ° ′	Log r	Log Δ
Oct. 11	23 41 24	+10 17·5		0·1732
15	34 27	9 37·9		
19	27 45	8 57·2	0·3757	0·1674
23	21 24	8 16·4		
27	15 29	7 36·1		0·1670
31	10 2	6 57·0		
Nov. 4	5 12	6 19·7	0·3473	0·1709
8	23 0 53	5 44·7		
12	22 57 12	5 12·6		0·1780
16	54 13	4 43·6		
20	51 53	4 18·0	0·3145	0·1869
24	50 9	3 56·0		
28	49 0	3 37·6		0·1964
Dec. 2	48 27	3 22·9		
6	48 29	3 11·7	0·2762	0·2054
10	49 3	3 4·2		
14	50 8	3 0·3		0·2130
18	51 45	2 59·9		
22	53 50	3 2·9	0·2307	0·2188
26	56 22	3 9·2		
30	22 59 19	+3 18·6		0·2218

The New Star in N.G.C. 6946.—A further account of the new star discovered by Ritchey in the spiral nebula N.G.C. 6946 (H. iv. 76 Cephei) has been given by Dr. Max Wolf (*Astronomische Nachrichten*, No. 4902), including a reproduction of a photograph taken with the Königstuhl reflector on August 21. The region is very rich in faint stars, but the only B.D. star in the neighbourhood is +59° 2662, magnitude 9·5, which is slightly preceding, and about 7′ north of the centre of the nebula. The nova was identified by comparison with earlier photographs of the nebula, and its estimated position, for 1917·0, was R.A. 20h. 33m. 3·1s., declination +59° 50′ 15″. The central star of the nebula follows the nova by about 4·05s., and is 105″ to the north. On August 21 the magnitude of the nova was estimated to be 13·5; on the photograph reproduced it appears to be less bright than the central star, but this is an illusion produced by the nebulosity about the latter, as in photographs taken with short exposures the nova was considerably the brighter. The nebula extends about 6′ to 7′ in the direction east and west, and the spirals exhibit a very complex knotted structure. The nova is situated near the southern end of an arm which runs obliquely from east to south of the central star. It was not possible to photograph the spectrum of the nova on account of the feeble luminosity.

WORK-HARDENED METALS.

One of the most interesting of the papers presented at the autumn meeting of the Institute of Metals was that by Prof. Jeffries, of the Case School of Applied Science, Cleveland, U.S.A. Hanriot came to the conclusion in 1912 that metals subjected to very high hydrostatic pressures, of the order of 10,000 kilograms per square centimetre, even though they underwent no change of shape, showed an increase of hardness (Brinell test). Although cubes of silver, copper, and aluminium showed a considerable increase of ball-hardness in these experiments, he decided that in no case were they appreciably deformed, and that the pressure was sufficient for hard-hammering the metals without deformation. Prof. Jeffries reviews this work, and has repeated the experiments. Tests were carried out by Dr. Bridgman with pure aluminium and an alloy containing 88 per cent. of aluminium and 12 per cent. of copper, in the form of cylinders 7/16 in. diameter by ½ in. long, the dimensions of which were accurately measured. The tensile strengths and scleroscope hardness values of the materials were determined with the following results :—

	Tensile stress lb. per sq. in.	Scleroscope hardness
Aluminium	14,890 ...	6·5
Aluminium-copper alloy ...	31,950 ...	24·0

Cylinders of each kind of metal were then exposed to a maximum pressure of 12,400 kg. per sq. cm. at 25° C., the transmitting liquid being petroleum ether mixed with kerosene. The pressure was maintained at the maximum for twenty minutes, and the total period of the test was about 2½ hours. The cylinders were then measured and found to be unaltered in size, and the following results were obtained in the subsequent tests :

	Tensile stress lb. per sq. in.	Scleroscope hardness
Aluminium	14,300 ...	6·5
Aluminium-copper alloy ...	27,300 ...	24·0

In the case of the alloy the threads were stripped at the stress specified, and the specimen was unbroken. Similar experiments at 40° C., using kerosene alone as the transmitting medium, gave a similar result, except for a slight increase of tenacity, and no alteration in structure was observed. These results contradict those of Hanriot, who found a 30 per cent. increase of ball-hardness in the case of aluminium under a hydrostatic pressure lower than the above. Bridgman directs attention to the fact that Hanriot used vaseline to transmit the pressure, and that this freezes hard under pressure, so that at the higher pressures the stress applied was not hydrostatic. This explanation is plausible. Prof. Jeffries concludes from these and other tests that the hardness of metals cannot be increased without permanent deformations unless such an increase in hardness is due to an allotropic change. The latter might, of course, cause either an increase or a decrease in hardness. As all Hanriot's results pointed to an increase of hardness it is probable that there was slight permanent deformation which he did not detect, and that this was the immediate cause of the increase.

In spite of the large number of researches which have been carried out, both on the purely scientific and technical aspects of the annealing of work-hardened metals and alloys, the subject still presents features which require more detailed investigation than they have yet received. The laws of annealing are considerably more complicated than the early investigators suspected. Especially does this apply to the first effects liable to be produced by heating. That in certain cases a hardening of the metal or alloy is produced, as measured by the tensile and ball-hardness